

NOT TOWNE
011 513

Report No. NADC-82075-60



LPU-21/P LIFE PRESERVER CASING MATERIAL PROGRAM

Jules Z. Lewyckyj
Aircraft Crew Systems Technology Directorate
NAVAL AIR DEVELOPMENT CENTER
Warminster, Pennsylvania 18974

October 1982
Final Report

NADC

Approved for Public Release; Distribution Unlimited

Tech. Info.

19970604 094

DEPT QUALITY INSPECTED

Prepared for
NAVAL AIR SYSTEMS COMMAND
Department of the Navy
Washington, D.C. 20361

8200395

NOTICES

REPORT NUMBERING SYSTEM – The numbering of technical project reports issued by the Naval Air Development Center is arranged for specific identification purposes. Each number consists of the Center acronym, the calendar year in which the number was assigned, the sequence number of the report within the specific calendar year, and the official 2-digit correspondence code of the Command Office or the Functional Directorate responsible for the report. For example: Report No. NADC-78015-20 indicates the fifteenth Center report for the year 1978, and prepared by the Systems Directorate. The numerical codes are as follows:

CODE	OFFICE OR DIRECTORATE
00	Commander, Naval Air Development Center
01	Technical Director, Naval Air Development Center
02	Comptroller
10	Directorate Command Projects
20	Systems Directorate
30	Sensors & Avionics Technology Directorate
40	Communication & Navigation Technology Directorate
50	Software Computer Directorate
60	Aircraft & Crew Systems Technology Directorate
70	Planning Assessment Resources
80	Engineering Support Group

PRODUCT ENDORSEMENT – The discussion or instructions concerning commercial products herein do not constitute an endorsement by the Government nor do they convey or imply the license or right to use such products.

APPROVED BY: _____


T. S. GALLAGHER
CAPT USN

DATE: _____

28 Sept 1982

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER NADC-82075-60	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) LPU-21/P Life Preserver Casing Material Report		5. TYPE OF REPORT & PERIOD COVERED Final
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Jules Z. Lewyckyj		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS Naval Air Development Center Aircraft and Crew Systems Technology Directorate Warminster, PA 18974		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS Naval Air Systems Command Department of the Navy Washington, DC 20360		12. REPORT DATE October 1982
		13. NUMBER OF PAGES 8
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		15. SECURITY CLASS. (of this report) Unclassified
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT (of this Report) Approved for Public Release; Distribution Unlimited		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number)		
<div style="display: flex; justify-content: space-between;"> <div> Aramid Plain Weave, Life Preserver Aramid Twill, Life Preserver Casing Material, Life Preserver </div> <div> Helicopter Life Preserver Life Preserver LPU-21/P Preserver, Life Preserver, Life </div> </div>		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number)		
<p>LPU-21/P Life Preserver Casings manufactured from High Temperature Aramid Cloth (MIL-C-81814) has a tendency to unravel at edges, making manufacture difficult with seam separation. A new Aramid Plain Weave Cloth (MIL-C-83429) does not unravel as easily. A number of preservers were manufactured from the new cloth and were given a special evaluation by operational squadrons. The casings withstood wear well and the new material would eliminate most of the raveling and seam separation problems.</p>		

DD FORM 1 JAN 73 1473

EDITION OF 1 NOV 65 IS OBSOLETE
S/N 0102- LF- 014- 6601UNCLASSIFIED
SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

TABLE OF CONTENTS

	<u>Page No.</u>
INTRODUCTION	1
DESCRIPTION	1
TEST PROCEDURE	1
RESULTS AND DISCUSSION	1
GENERAL	1
CONDITIONS OF WEAR	1
WEAR	1
MAINTENANCE	4
STOWAGE	4
OVERALL PERFORMANCE	5
GENERAL COMMENTS	5
CONCLUSIONS	5
APPENDIX A	
Evaluation Form: LPU-21/P Aircrewmen Life Preserver Casing Fabricated with MIL-C-83429, Type II, Class 1 Cloth (Contract No. N00383-80-C-4391)	A-1
APPENDIX B	
Pilot Evaluations for Use of LPU-21/P Life Preserver Casing Material, MIL-C-83429 (Type II Class 1) (SH-3 Pilots in HS-1)	B-1

LIST OF FIGURES

<u>Figure</u>		
1	MIL-C-81814 100% Nomex Aramid	2
2	MIL-C-83429 (Type II Class 1) 95% Nomex, 5% Kevlar	3

LIST OF TABLES

<u>Table</u>		
I	Comparison of Material Properties	4

~~19970604 054~~

DTIC QUALITY INSURED

INTRODUCTION

BACKGROUND

The present LPU-21/P Life Preserver Casing is manufactured from MIL-C-81814, High Temperature Resistant Aramid Twill Cloth. This particular form of NOMEX has a tendency to unravel at its edges, making a casing very difficult to manufacture and sewn seams separate after manufacture because of this unraveling. A number of preservers were manufactured from MIL-C-83429, Aramid Polyamide Non-Melting Plain Weave Cloth for a special evaluation by operational squadrons. This cloth does not unravel as easily as the filament fabric. Helicopter crews were given these life preservers and were asked to fill out questionnaires evaluating the new casings.

This program was authorized by the Naval Air Systems Command and had a priority listing on the "NAVAIR ALSS/ILS/AMP TASK/PRIORITY LIST" with a priority of II A-9 titled "Nomex cases on LPU-21/P life preservers unravel and separate at the seams."

DESCRIPTION

The original LPU-21/P Life Preserver Casings are manufactured from MIL-C-81814 cloth (figure (1)). The new casing material is MIL-C-82429 (figure (2)). A comparison of some differing properties is given in table I. Casings were manufactured to the same design as that for the LPU-21/P using the new material.

TEST PROCEDURE

Forty-three complete life preservers were forwarded to Helicopter Anti-Submarine Squadron ONE, Naval Air Station, Jacksonville, FL. Questionnaires were forwarded to the squadron to be filled out by wearers of the life jackets. The questionnaire is shown in appendix A.

RESULTS AND DISCUSSION

GENERAL

Fifty-six percent of the questionnaires were answered, all by pilots. Results of the questionnaires are summarized in appendix B.

CONDITIONS OF WEAR

The preservers were worn by pilots who were between 5 ft. 8 in. at 135 lb. and 6 ft. 3 in. at 200 lb. (The pilots had between 300 and 3200 hours of flying time in their careers with an average of 1938 hours). The preservers were worn during regular flight duties for between 20 and 150 hours with an average of 64 hours of wear.

WEAR

In general, the casings withstood wear very well. Seams separated in 16% of the preservers (84% showed no separation). Pilling occurred only in 5% of the preservers and fading or silk screening rubbing off occurred in only 5% of the preservers. Bindings pulled off in 9% of the preservers with 91% showing no damage.

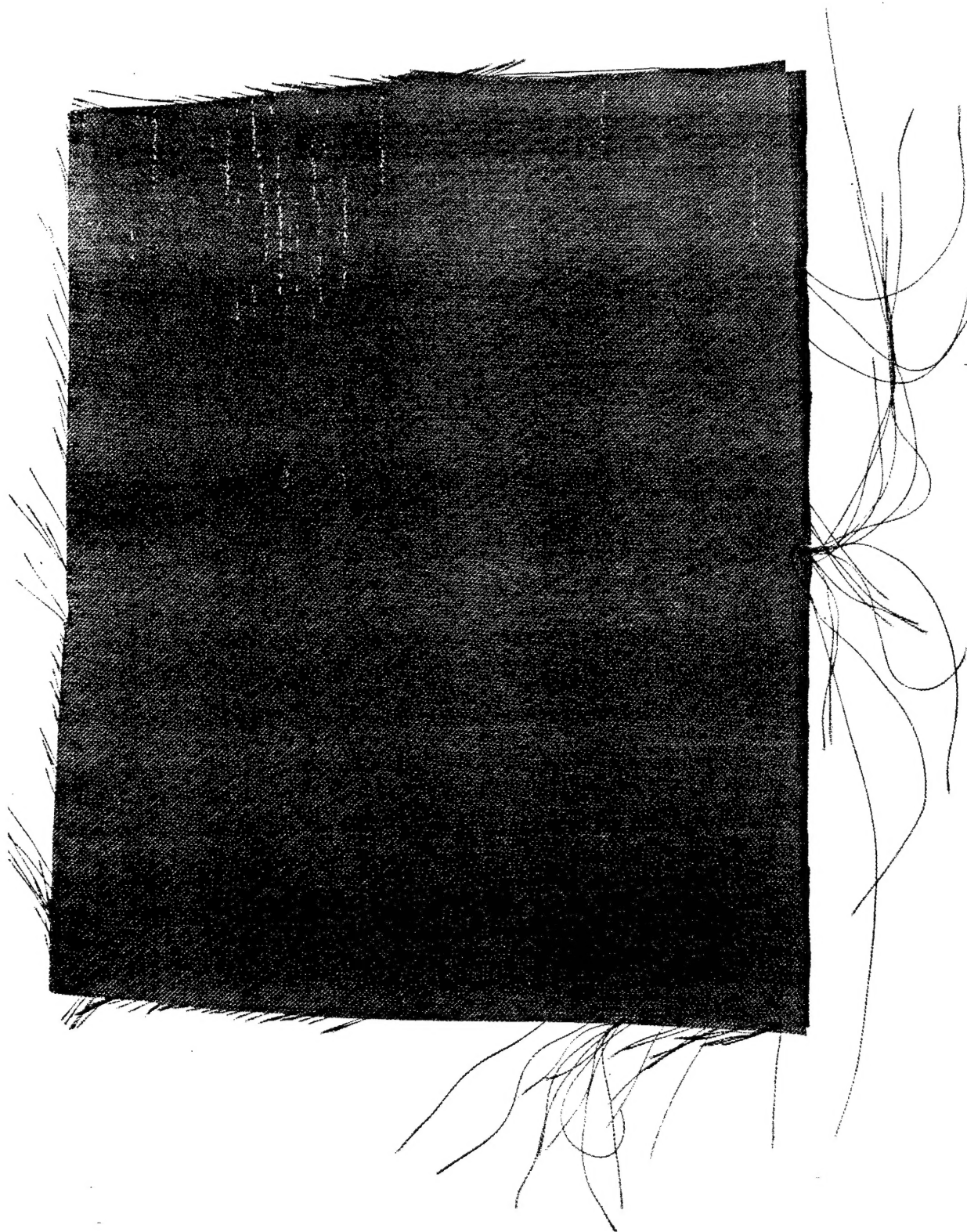


Figure 1 — MIL-C-81814 100% Nomex Aramid

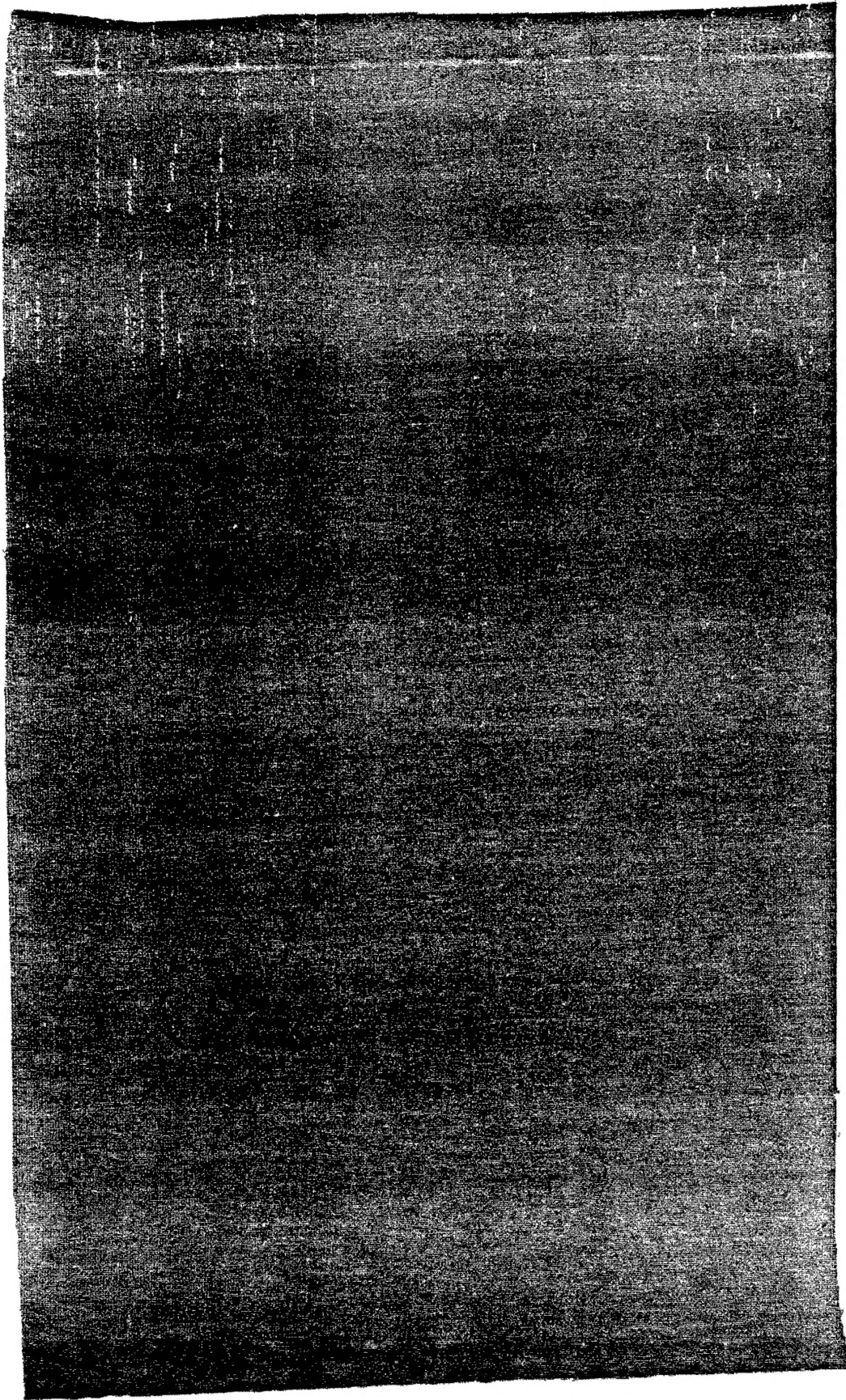


Figure 2 — MIL-C-83429 (Type II Class 1) 95% Nomex, 5% Kevlar

TABLE 1 — COMPARISON OF MATERIAL PROPERTIES

	MIL-C-81814 "Cloth, Twill, Aramid, High Temperature Resistant"	MIL-C-83429 Type II Class I "Cloth, Plain and Basket Weave, Aramatic Polyamide Non-Melting"
Fiber	"Nomex" High Temp. Aramid, 200 Denier filament	95% Nomex, 5% Kevlar Non-melt Aromatic polyamide staple
Weave	2/2 right hand twill	Plain
Weight (oz/yd ²)	5.2-5.6	4.3
Yarns/inch	98	70
Warp	90	47
Denier/filament	2	1.5
Breaking strength (lb.)		
Warp	185	180
Fill	160	100
Tear strength (lb)		
Warp	13	12
Fill	13	8
Air Permeability (ft ³ /min/ft ²)	12	25
Flame Resistance		
Flame Time (Sec)	1	2
Glow Time (Sec.)	14	25
Char Length (in.)	3.5	3.5
Stability after laundering (Max. shrinkage in %)		
Warp	2	4
Fill	2	1.5

MAINTENANCE

No maintenance problems were encountered.

STOWAGE

About half of the pilots (52%) encountered problems in repacking the preserver in its casing. The bladder pushed out at the neck by opening up of the velcro. However, this problem was not caused by the new material; the tightness of the casing at the neck is part of the original LPU-21/P design.

OVERALL PERFORMANCE

Ratings were split at 1/3 each for "Very Good", "Good" and "Adequate".

GENERAL COMMENTS

About one-third of the questionnaires included "Comments". These were all favorable with regard to the new material.

CONCLUSIONS

In general, the new MIL-C-83429 material may be considered satisfactory for manufacture of LPU-21/P life preserver casings. It would eliminate the raveling and seam separation problems which occur with MIL-C-81814.

The problem with neck separation of the casing which allows the bladder to push out must be addressed by a minimal redesign of the casing.

APPENDIX A

EVALUATION FORM

LPU-21/P AIRCREWMEN LIFE PRESERVER CASING FABRICATED WITH
MIL-C-83429, TYPE II, CLASS 1 CLOTH (CONTRACT NO. N00383-80-C-4391)

INTRODUCTION

The LPU-21/P Life Preservers fabricated with MIL-C-83429 Type II Class 1 cloth have been produced to evaluate an alternative cloth to the MIL-C-81814 aramid cloth which is currently specified for use in the casing.

PURPOSE

The purpose of this evaluation is to collect data on user acceptance and operational suitability of LPU-21/P life preserver casings fabricated with MIL-C-83429 cloth. This information will be used to determine the suitability of this cloth for future procurements of life preserver casings. Your contribution to this evaluation is both important and appreciated. When you have completed this evaluation form, please return to:

Commander
Naval Air Development Center
Code 60313
Warminster, PA 18974

1. Name and Rank _____ 2. Date _____

3. Organization/Squadron _____

4. Aircraft Type _____

5. Height _____ 6. Weight _____

7. Crew Position:

Pilot _____ Co-Pilot _____ RIO/NFO _____ Other _____

8. Your approximate total flight hours _____

9. Approximate total hours the evaluation item was worn _____

10. Describe the overall performance of the life preserver during flight.

Very good _____ Good _____ Adequate _____ Poor _____ Very Poor _____

11. Were any of the following failures observed during the evaluation period?

Seam Separation Yes _____ No _____

Excessive Pilling Yes _____ No _____

Pulling off of Bindings Yes _____ No _____

Fading or Rub-off of
Silk Screened Information Yes _____ No _____

Comments: _____

12. Were there any maintenance problems during use? Yes _____ No _____

If so, describe _____

13. Did you observe any problems with the stowage of the life preserver in the casing?
Yes _____ No _____

If so, describe _____

14. Overall Comments or Recommendations: _____

APPENDIX B

PILOT EVALUATIONS FOR USE OF LPU-21/P
LIFE PRESERVER CASING MATERIAL, MIL-C-83429 (Type II Class 1)
(SH-3 PILOTS IN HS-1)

PILOTS: 5 ft. 8 in./135 lb. to 6 ft. 3 in./200 lb.

Total Flight Hours: 300-3200; Average — 1938
Hours LPU-21/P Worn: 20-140; Average — 64

*OVERALL PERFORMANCE RATINGS: Adequate — 33%
Good — 33%
Very Good — 33%

*WEAR:

Seam Separation	No — 84%	Yes — 16%
Excess Pilling	No — 95%	Yes — 5%
Pulling Off Binding	No — 91%	Yes — 9%
Fading/Silk Screen Rub Off	No — 95%	Yes — 5%

MAINTENANCE PROBLEMS: None.

*STOWAGE PROBLEMS: No — 48%; Yes — 52%

* Figures given are for percentage of respondents answering each question.

NADC-82075-60

No. of Copies

Commander, USAADC (ATSA-CD).....	1
Commander, USAIC (ATSH-CD)	1
Commander, MP CMLSCH TNGCEN (ATZN-CM)	1
Commander, USASIG CTR (ATZH-CD)	1
Commander, USA Institute for Military Assistance (ATSU-CD)	3
Commander, USAARMC (ATZK-CD/ATZK-ADD).....	1
Commander, USAEC (ATSE-CTD)	1
Commander, USAFAC (ATSF-CTD)	1
Commander, USAINCS (ATSI-CD).....	1
Commander, U.S. Ordnance Ctr & Sch (DCD)	1
Commander, USAQMCS (ATSM-CD)	1
Commandant, USATSCH (ATSP-CD).....	1
Commander, U.S. Marine Corps Dev. & Ed. Command, Dev. Ctr. (M&L Div).....	1
Commander, USAF SYS. COMMAND (SDNE).....	1
Commander, USARIEM (SGRD-UE-ME).....	1
Commander, USATARCOM (DRCPO -ALSE/DRSTS-T)	1
Manager, ARNGB OAC (MGB-AVN-L).....	1
HQDA (DAMO-NCC/DAMA-ZC/DASG-PSP/DAMO-RQD).....	3
Commander, USAARL (SGRD-UAC)	1
Commander, USASC	1
Commander, USAREUR & 7th Army (AEAGC-AV/AEAGC-NC).....	2
Commander, USAFORSCOM (AFOP-AV/AFOP-TAS).....	2
Commander, U.S. Eighth Army (CJ-EA).....	1
Commander, WESTCOM (AFOP-AV)	1
Commander, USAHEL (DRXHE-EA)	1
Commander, HQ TAC/DRPS (MAJ Greenard), Langley AFB.....	1
Commander, ERADCOM (DRDEL-CM)	1
Commander, Harry Diamond Lab (DELHD-N-P).....	1
Commander, USA Environmental Hygiene Agency (HSE-RL).....	1
Commander/Commandant, USCS (G-OSR-2/32 COMDR-SETTER).....	2
Commander, USAAVRADA (DAVAA-d).....	1
Commander, USATECOM (DRSTE-AV).....	1
Commander, USAAMSAA (DRXSY-MR).....	1
Commander, USALEA (DALO-LEI).....	1
Commanding General, U.S. Army Aeromedical Research Lab, (ATZQ).....	1
Commanding General, HQ, ASD, Wright-Patterson AFB.....	3
Commanding General, U.S. Army Aviation Systems Command	3
Commanding General, HQ, Fifth Army	1
Commanding General, U.S. Army Combat Developments Activity	1
Commanding Officer, David W. Taylor Naval Ship Research and Development Center	1
(1 for Fire Fighting and Survivability Branch)	
Commanding General, U.S. Army Agency for Aviation Safety	1
Commanding General, U.S. Army Research Institute of Environmental Medicine	1
Commanding General, U.S. Army Flight Facility	1
Commanding General, HQ, TRADOC, (ATCD).....	3

NADC-82075-60

	<u>No. of Copies</u>
Commanding General, HHC	1
David Clark Company, Inc.	1
Payne Inc.	1
Grumman Aerospace Corp.	1
Lockheed Aircraft Corp.	1
United Aircraft Corp.	1
General Dynamics Corp.	1
McDonnell Douglas Corp.	1

NADC-82075-60

No. of Copies

U.S. Dept. of the Interior, Office of Aircraft Services.....	1
(1 for L. Langdon)	
W.L. Gore & Associates, Inc.	3
Dayton T. Brown, Inc.	1
(1 for Test Laboratory Division)	
Commanding Officer, VC-13	2
Commanding Officer, VF-302	2
Commanding Officer, Fighter Squadron THREE ZERO TWO	2
Commanding Officer, HELSUPPRON ONE	1
Commanding Officer, Naval Regional Medical Center, Portsmouth.....	1
Commanding Officer, NAS North Island .	1
(1 for Code 582)	
Commanding General, 3rd MAW (FMFPAC	1
Commanding General, 1st MAW, FMFPAC	1
Commanding General, MAG-24, 1st M	1
Commander, COMFITAEEWWINGPA	1
(1 for Code 81)	
Chief of Naval Air Training	1
(1 for Code 5113)	
Commander, Naval Air Force U.S. /	1
(1 for Code 522E)	
Commanding Officer, HC-16	1
Commanding Officer, HC-1	1
Commanding Officer, Naval Air Eng	1
(1 for Code 9312)	
Commanding Officer, MAG-31	1
Officer In Charge, Branch Clinic, N/	2
Commanding Officer, Naval Weapor	2
(2 for Code 3023)	
Commanding Officer, HS-84	1
Commanding General, 2nd Marine /	1
Commanding Officer, MAG-26, 2nd	1
Officer in Charge, Naval Sea System	
Combatant Craft Engineering Dej	3
Director, National Aeronautics and	3
Commandant, U.S. Coast Guard He	
Research & Development	3
Officer In Charge, U.S. Navy Clothi	
Facility, Natick	3
Canadian Armed Forces, National D	1
Commanding Officer, Naval Avionics Center.....	1
(1 for Code D432)	
Commander, USANVL, (DELNV-D/DELNV-SI), Fort Belvoir, VA	1
Commander, CSL (DRDAR-CL/DRDAR-CLW), Aberdeen Proving	
Ground, MD	1
Commander, USADARCOM (DRCNC/DRCDE-DG/DRCDE-DH/DRCDE-BSI)	3
Commander, USACAC (ATZL-CAM-IM/ATZL-CAM-IC)	1
Commander, USALOGC (ATCL-MPP/ATCL-MS)	1

U 820 0395

N.A.D.C.

NADC-82075-60

DISTRIBUTION LIST

REPORT NO. NADC-82075-60

	<u>No. of Copies</u>
Commander, Chief of Naval Operations	1
(1 for OP-506N)	
Commander, Naval Air Systems Command	6
(3 for AIR-531)	
(1 for AIR-4114A)	
(1 for AIR-340B)	
(1 for AIR-09E)	
Commanding Officer, Naval Aviation Schools Command	2
Commanding Officer, FASOTRAGRUPAC	2
Commander, Naval Weapons Center	5
(5 for Code 6412)	
Commander, Pacific Missile Test Center	1
(1 for Code 1131)	
Commander, Naval Safety Center	2
Chief of Naval Education & Training	1
(1 for Code 421)	
Commanding Officer, MAWTS-1	1
Commanding Officer, Aviation Supply Office	3
(2 for Code TE044-A)	
Commander, Naval Air Force, U.S. Pacific Fleet	3
(1 for Mr. Ben Withers)	
(1 for Code 7212)	
(1 for Code 711)	
Officer In Charge, Naval Regional Medical Center Aviation Physiology Training Service	1
Commanding Officer, U.S. Coast Guard Air Station, San Diego	2
Marine Corps Development & Education Command Air Branch, Fire Power Division, Development Center	2
(2 for Code D09-2)	
Commander, Light Attack Wing Pacific	1
(1 for Code 9733)	
Commanding Officer, Naval Air Technical Services Facility	1
Commanding Officer, Naval Air Rework Facility	1
(1 for Code 3331)	
Commanding Officer, H&HS-48 MACG-48	2
Commanding Officer, Naval Air Rework Facility, Naval Engineering Support Office	2
(2 for Code 321)	
Commanding Officer, TRITON THREE ZERO ONE	2
Commander, Chief of Naval Reserve	1
(1 for Code 37)	
H. Koch & Sons, Anaheim, CA	1
(1 for J. A. Muklevicz)	
Donax Corp.	1
(1 for S. J. Wojdan)	
ILC Dover	1
(1 for R. Desrosier)	

200395